

What is claimed is:

~~1. A surface acoustic wave device comprising:
a piezoelectric substrate having a pair of substrate
edges and an upper surface therebetween and including a main
region and a bottom surface, the piezoelectric substrate
having at least one inner edge arranged to contact the main
region and to extend from the upper surface toward the bottom
surface of the piezoelectric substrate inside one of the
substrate edges;
an interdigital transducer provided on the main region of
the piezoelectric substrate such that a shear horizontal type
surface acoustic wave excited by the interdigital transducer
and having a wavelength of λ are reflected by the at least one
inner edge;
wherein a distance L between the at least one inner edge
and the corresponding one of the substrate edges is
substantially equal to about 8λ or less.~~

~~2. A surface acoustic wave device according to claim 1,
wherein the at least one inner edge has a height H in the
range of about 2λ to about 6λ .~~

~~3. A surface acoustic wave device according to claim 1,
wherein the surface acoustic wave device comprises one of a
surface acoustic wave resonator, a longitudinally coupled
resonator filter, a transversely coupled resonator filter, and
a ladder type filter.~~

~~4. A surface acoustic wave device according to claim 1,
wherein the piezoelectric substrate is made of at least one of
piezoelectric ceramics and piezoelectric single crystals.~~

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5. A surface acoustic wave device according to claim 1, wherein the upper surface of the piezoelectric substrate has a pair of grooves arranged substantially parallel to the substrate edges and extending from the upper surface toward the bottom surface.

6. A surface acoustic wave device according to claim 5, wherein the pair of grooves have inside surfaces arranged to contact the main region of the upper surface and defining inner edges for the main region.

7. A surface acoustic wave device according to claim 1, wherein the inside surfaces define reflection edges for reflecting the shear horizontal type surface acoustic wave.

8. A surface acoustic wave device according to claim 5, wherein at least two IDTs are disposed between the grooves on the upper surface of the piezoelectric substrate.

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9. A surface acoustic wave device according to claim 8, wherein the at least two IDTs include a plurality of electrode fingers, and if the wavelength of the surface acoustic wave is represented by λ , the widths of the outermost electrode fingers of the at least two IDTs are approximately $\lambda/8$ and the widths of all of the other electrode fingers are approximately $\lambda/4$.

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10. A communication device comprising:
at least one surface acoustic wave device including:
a piezoelectric substrate having a pair of substrate edges and an upper surface therebetween and

including a main region and a bottom surface, the piezoelectric substrate having at least one inner edge arranged to contact the main region and to extend from the upper surface toward the bottom surface of the piezoelectric substrate inside one of the substrate edges;

an interdigital transducer provided on the main region of the piezoelectric substrate such that a shear horizontal type surface acoustic wave excited by the interdigital transducer and having a wavelength of λ are reflected by the at least one inner edge;

wherein a distance L between the at least one inner edge and the corresponding one of the substrate edges is substantially equal to about 8λ or less.

11. A communication device according to claim 10, wherein the at least one inner edge has a height H in the range of about 2λ to about 6λ .

12. A communication device according to claim 10, wherein the surface acoustic wave device comprises one of a surface acoustic wave resonator, a longitudinally coupled resonator filter, a transversely coupled resonator filter, and a ladder type filter.

13. A communication device according to claim 10, wherein the piezoelectric substrate is made of at least one of piezoelectric ceramics and piezoelectric single crystals.

14. A communication device according to claim 10, wherein the upper surface of the piezoelectric substrate has a

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pair of grooves arranged substantially parallel to the substrate edges and extending from the upper surface toward the bottom surface.

15. A communication device according to claim 14,
wherein the pair of grooves have inside surfaces arranged to
contact the main region of the upper surface and defining
inner edges for the main region.

July 1 16. A communication device according to claim 15, wherein the inside surfaces define reflection edges for reflecting the shear horizontal type surface acoustic wave.

17. A communication device according to claim 14, wherein at least two IDTs are disposed between the grooves on the upper surface of the piezoelectric substrate.

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18. A communication device according to claim 17, wherein the at least two IDTs include a plurality of electrode fingers, and if the wavelength of the surface acoustic wave is represented by λ , the widths of the outermost electrode fingers of the at least two IDTs are approximately $\lambda/8$ and the widths of all of the other electrode fingers are approximately $\lambda/4$.